THE PROMISE OF RAIN: PRODUCTION NOTES

The Promise of Rain is a short movie produced by the television and multimedia team based at the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC). The Global Precipitation Measurement (GPM) development office commissioned the movie as a vehicle to introduce their work to a wider audience of policy makers, scientists, students, and the interested public.

The project came together during the spring of 2001. Pre-production and creative development proceeded rapidly through March and April. The team finished principal photography on April 9th; the first public presentation of the movie took place on May 16th.

GSFC TV shot footage for the project at the University of Maryland Agricultural Experiment Station in Laurel, Maryland. The production chose to shoot in HDTV (High Definition TeleVision). Though initially crafted for performance in a standard television format, the HDTV source material not only gives the original footage a sparkling clarity, but also enables future modifications to be made to the project, should it ever be re-cut for HD distribution.

The visual intention behind The Promise of Rain seeks to engender feelings of creativity and enthusiasm, while also providing information and educational content. In the surreal setting where much of the movie takes place, viewers are encouraged to consider their own relationship not only to precipitation and climate, but also to the many ways they affect countless elements of our lives.

The animation shop called Studio Thirteen located at GSFC developed the satellite animations. They were based on initial design specifications provided by the GPM development office. Studio Thirteen also developed conceptual and scientific animations for the movie. Additional animations came from Max-Q Digital, a multimedia production company based in Maryland.

Video editing and post-production special effects took place in the non-linear edit suites at GSFC. The team maintained a footage archive on a digital video server and prepared the final cut entirely in virtual space.

To help create feelings of imagination and inventiveness, the production team supplanted the idea of a traditional soundtrack with that of a "sonic landscape". Although infused with a musical heart, the sound design is really a collage intended to evoke wonder and inventive energy in a slightly fantastic aural environment. Sonica Music developed the sound design in New York City. They delivered a state-of-the-art multi-track digital stereo recording for the final edit. Max-Q Digital took Sonica's original composition and engineered the post-production audio mix at their studios in Columbia, Maryland.

GPM: THE FUTURE OF PRECIPITATION RESEARCH

The value of understanding how precipitation affects climate and weather cannot be overstated. Precipitation is responsible for releasing energy into the atmosphere and it is a vital link in the Earth's water cycle. Rain, snow, humidity, and other precipitation conditions offer clues to the current and changing nature of the world's climate. Further, changes in precipitation patterns one place on Earth can have profound impacts elsewhere. It is therefore incumbent on the global scientific community to understand it better.

To this end, NASA and the National Space Development Agency of Japan (NASDA), undertook the Tropical Rainfall Measuring Mission (TRMM) in the 1990s. A dedicated spacecraft and monitoring system, TRMM provided unprecedented insight into the workings of rainfall and climate interactions. Based on the efforts of that highly successful project, experts in the United States and Japan are planning for the future.

Enter GPM.

GPM is far more than a continuation of TRMM. Its goals include a vastly increased geographic scale of precipitation detection and significantly improved analytic capabilities. Unlike the TRMM project, which could only detect precipitation in tropical latitudes, GPM will be able to observe precipitation conditions over a vast majority of the Earth's surface. What's more, GPM will be able to gather world wide precipitation data at a temporal scale greatly improved as compared to TRMM.

These advances will be made possible by a dramatically new way of staging a remote sensing mission. Instead of a single advanced spacecraft looking at the Earth, GPM will include a sophisticated fleet of orbiting instruments. A principal vehicle will carry advanced monitoring equipment, while as many as eight additional precipitation sensors onboard other satellites will gather wide scale information around the world. Multiple platforms mean that more of the Earth can be seen at once, thus increasing the temporal resolution of precipitation events. Additionally, a worldwide network of ground stations will help researchers monitor and validate satellite data. This multinational network will afford unique research tools for climatologists at both local and global scales, as well as exciting educational opportunities for primary school, college, and graduate students around the world.

For more on GPM visit them on the web at http://gpm.gsfc.nasa.gov.

A BRIEF HISTORY OF TRMM

GPM may be a new mission, but based on its lineage it already has a lot going for it.

Prior to GPM there was TRMM. In fact, as of early spring 2002, TRMM is still on orbit and performing well. Based on TRMM's widely acclaimed successes, GPM begins its development with a great deal of momentum and knowledge behind it.

TRMM is the first Earth Science mission dedicated to studying tropical and subtropical rainfall, precipitation that falls within 35 degrees north and 35 degrees south of the equator. Tropical rainfall comprises more than two-thirds of the world's total. The satellite uses several instruments to detect rainfall including radar, microwave imaging, and lightning sensors. Flying at a low orbital altitude of 217 miles (350 kilometers), TRMM's study of tropical rainfall and attendant processes is helping improve our understanding and predictions of global climate change. Using data from TRMM, researchers have been able to literally map the inside structure of hurricanes from space in ways analogous to how doctors use a CAT scan to peer inside a patient's body. The TRMM team also developed the first complete rainfall maps for the tropics. Appearing like wispy blue filigrees against the peaceful colors of the Earth, these maps are helping experts understand the transport of energy in the atmosphere, as well changing climate conditions around the globe.

NASDA launched the satellite on an H-II rocket from Tanegashima Space Center on November 27, 1997. TRMM data is

available to researchers around the world. A team at NASA's GSFC in Greenbelt, Maryland manages the mission.

For more on TRMM visit them on the web at http://trmm.gsfc.nasa.gov.

WHAT IS PRECIPITATION?

In terms of meteorology, precipitation is water in a solid or liquid form that falls through the atmosphere. Although generally associated with water that reaches the ground, not every particle that coalesces and falls through the sky in fact makes all the way to the surface.

Simply speaking, precipitation is a function of water changing its material state from vapor to a liquid or a solid. But more specifically, two fundamental steps must take place for water to fall from the sky. The first is that basic precipitation components must develop. These include ice crystals that form around various minute particles in the atmosphere such as dust or salts. These are called deposition nuclei. Similar particles that facilitate water droplets to form are called condensation nuclei.

The second step is for those ice crystals or condensed droplets to grow. There are a number of ways this can happen. One common process is called aggregation, a sequence of joining through collision or freezing with other crystals or droplets. Because of their increasing size, these larger droplets or ice crystals are more apt to collide with other particles of water, and thus more likely to fall or "precipitate" out of a cloud.

HOW DOES THE WATER CYCLE WORK?

What the circulatory system is to a person, the water cycle is to the Earth. This fundamental process is imperative for life, as well as climatological stability around the world.

Although a common molecule made of three ordinary atoms—two hydrogen, one oxygen—water is a complicated, dynamic substance. It easily interacts and combines with other materials and it can also change its physical state easily. Further, water tends to migrate, passing from one location to another as it changes form and interacts with other parts of the natural world.

The first step in the cycle is evaporation. Heated by sunlight, water turns to vapor and enters the atmosphere. When enough of it evaporates and other weather conditions are right, water vapor forms a cloud.

Another source of atmospheric water vapor is the respiratory process of plants. Vapor leaves plants through tiny pores called stomata. This process is called transpiration.

Pressure and temperature conditions play an important role in how much moisture the atmosphere can hold. When a given quantity of atmosphere has no more storage capacity, we see the next phase in the water cycle: condensation. Droplets of water coalesce from traces of vapor, and as they gain size by joining with other droplets, they yield the next part of the water cycle. This is called precipitation.

Precipitation can be rain, snow, high humidity, or other means by which water falls out of the sky. It's a process that tends to distribute water over a wide area. Water falling via precipitation does not necessarily reach the ground. Some of it evaporates as it falls, returning immediately to the atmosphere as vapor. Plants absorb and use some of it. But of the precipitation that reaches the ground, there are generally two ways it can return to larger bodies

of water. Infiltration is the process by which water soaks into the Earth, either through soil, or cracks in rock, or sand, or other materials. Gradually this water will migrate and find its way to larger bodies like lakes and rivers and oceans.

A more direct means of reaching bigger bodies of water is through runoff. Water that simply cannot be absorbed by the surface finds its way to other reservoirs.

The cycle is endless, with water travelling through the biosphere via clouds and streams and rain every day. Considering how vital it is for life to thrive, an understanding of its processes and functions are important to people all over the world.

NASA'S REMOTE SENSING LEGACY

NASA has been studying our home planet from space since 1972. Since then, NASA has helped extend the limits of both research methods and technological know-how for Earth science.

The early years of remote sensing helped prove the worth of such complex endeavors. By studying the Earth from a distance, the values of scale and perspective could be applied to maximum advantage in ways that could never have been done prior to orbiting observatories.

As the decades have advanced, the space agency has refined its skills. From the comparatively simple land surface measuring instruments in the early years, NASA now maintains a fleet of highly sophisticated instrumentation on orbit. Landsat 7, the workhorse of the land imaging fleet has proved to be a powerful success, and a proud continuation of a long history of surface measuring systems.

Terra is the name of the new Earth observing flagship satellite. Composed of five distinct yet interrelated instruments, Terra describes the future of remote sensing. It and its sibling platforms currently being readied for launch highlight the value of studying the Earth in terms of systems, as opposed to a collection of discrete processes.

Missions like TRMM, SeaWiFS, and Earth Probe TOMS, have each dramatically transformed our working knowledge about the Earth. Data about climate, the carbon cycle, and atmospheric ozone are now available to researchers in the form of dynamic models that can be analyzed in detail far beyond what could be done prior to launch of those satellites.

With the deployment of GPM, experts anticipate new levels of understanding about precipitation and the world's climate will bolster NASA's and NASDA's already important contribution to the world's base of scientific knowledge about our living planet.

GPM.
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